621

7-FOLD CONCENTRATE

Roderick K. Eskew tells of the fruit juice developed at the USDA's Eastern Regional Research Laboratory for the Armed Services, especially welcome on submarines.

FLAVORFUL, nutritious fruit juice in highly concentrated form is an important need of the Armed Forces.

In 1944 the Eastern Regional Research Laboratory in Philadelphia developed a process for recovering in concentrated unaltered form the aroma[1] of fresh apple juice.[2]. This made possible the preparation of a full-flavor juice concentrate—i.e., one containing the true fruit aroma which would normally be lost in concentrating the juice. This was accomplished by first recovering the essence, then concentrating the stripped juice under vacuum and finally restoring the essence to the concentrate.

Continued research on this process has resulted in refinements in technique and apparatus which improve its use with apple juice and make it applicable to juices of other fruit. It is now possible to prepare 7-fold concentrates of grape juice as well as of apple juice. On the addition of 6 volumes of water these concentrates will yield juices having the flavor and fragrance of fresh juice. A 6-ounce can of these highly condensed products will yield 42 ounces of juice. For example, a 7-fold grape juice concentrate having a Brix of 72.8° would yield, on dilution, a beverage of 13.5 Brix, the concentration at which sweetened grape juice is customarily consumed. Correspondingly, a 7-fold apple concentrate of 68.5° Brix would yield on dilution a beverage of 12.5 Brix. This compact form is of particular interest to the Navy. Juices which occupy only 1/7th their normal volume are well adapted to submarine use where every inch of space is at a premium. In this regard the high-density concentrates are superior to the ordinary 4-fold frozen concentrates familiar to the housewife.

High-density concentrates can be successfully stored and distributed frozen by the same procedures used for 4-fold concentrates. Unlike frozen 4-fold concentrates, which will spoil rapidly if the temperature remains at 35° F., high-density concentrates do not necessarily spoil at 35° F. In pilot plant tests of such concentrates no spoilage or deterioration of flavor was experienced in a year's storage at 35° F. The procedures involve pasteurization (during essence stripping), handling by sanitary methods, concentration to high sugar content, and storage at low temperature. Positive protection against the possibility of spoilage from micro-organisms which might enter during canning and which might be active at 35° F., at this high density, can be obtained by keeping frozen, by aseptic canning, or hot packing. Since the last two named might jeopardize flavor, freezing is much preferable.

These 7-fold concentrates can also be used as a base for carbonated beverages, or in making ices, candy, table sirups, and other foods.

In spite of the merits of the high-density products they will not necessarily replace the familiar 4-fold frozen juice concentrates for household consumption. The flavor of the two products is slightly different—the choice is a matter of personal preference.

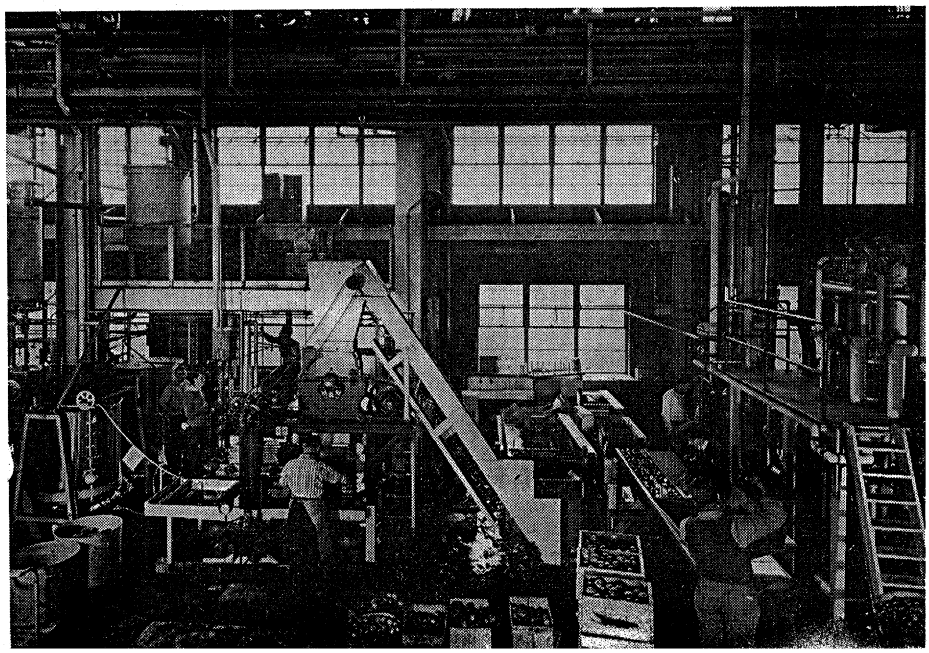
Cost estimates show that a plant already producing single strength apple juice at a rate of one-half million gallons a year could convert to the production of the 7-fold concentrate for a capital expenditure of around $220,000. In such a plant it would cost a little more to make a 6-ounce can of the high-density product than to make the same size can of a 4-fold frozen concentrate. However the cost per glass of reconstituted juice would be less in the case of the 7-fold product.

Information on the process and cost to manufacture high-density apple juice concentrate can be had by writing to the Eastern Regional Research Laboratory for AIC-315, "High Density, Full-Flavor Apple Juice Concentrate."

For Concord grape juice, earlier studies[3] indicated that for complete recovery of the aroma it would be necessary to strip off a first essence from the juice and then recover a second essence by processing the distillate obtained during vacuum concentration of the stripped juice. By means of improved design in essence recovery equipment it has now been found that 30 per cent vaporization adequately recovers the aroma in the grape juice.

The early full-flavor grape juice concentrate had a Brix of 68°. This was an unsweetened product suited to industrial use in making grape flavored products such as candy, carbonated beverages and ices; or it could be sold at retail for reconstitution with water to give a juice typical of the unsweetened bottled product now on the market. More recently we have carried the concentration further to make a product of about 73° Brix corresponding to a 7-fold concentrate,—i.e., 6 volumes of water should be added to 1 volume of the concentrate. To enhance its popular appeal sugar was added. The work was done on Concord grapes grown in the Great Lakes District, and was carried out as a consequence of the Navy's interest in a concentrate of low bulk capable of yielding a flavorful grape juice. It is now under actual tests in a submarine where its fresh flavor should be welcome to men confined under conditions prejudicial to good appetite.

PILOT PLANT. Apples are processed into 7-fold full-flavor concentrate.



REFERENCES

[1] See Code of Federal Regulations, Title 26, Pt. 198, 1950. Volatile Fruit Flavor Concentrates.

[2] Howard P. Milleville and Roderick K. Eskew, "Recovery and Utilization of Natural Apple Flavors," USDA. Bur. Agr. and Ind. Chem. AIC-63, (Eastern Regional Research Laboratory) Sept. 1944, with Supplement of Apr. 1945. (Processed).

[3] R. P. Homiller, G. W. Macpherson Phillips, R. K. Eskew and N. H. Eisenhardt, "Two-Pass Concentration Technic Obtains Full-Flavor Grape Juice," FOOD INDUSTRIES, Vol. 22, pp. 1026-1028, 1950.